# Marvel

## Manufacturing Company

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# P/N 3015, 3037, Balance Indicator Arbor Application, Operation & Maintenance

**The 3015, 3037 Balance Indicator Arbor and supplementing accessories furnished in various kits are produced to apply the Horizontal Suspension Static Balance Principle to aircraft propellers which incorporate face type mount flanges and internal control mechanisms such as are common to both low and high horsepower turbine installations.**

**Interface between the indicator arbor and the propeller mount face is made with suitable adapters which attach to the lower end of the arbor and simulate the face of each type of engine flange. During the balance operation the propeller is completely assembled, including the spinner, with the blades pitched to a desired setting.**

**All 3015, 3037 Arbor balance installations require use of accessory backbalance weights to provide vertical adjustment for the center of gravity of the total suspended load to obtain proper arbor operation. Refer to instruction for the propeller model to be balanced for installation procedure and setting position of this weight or apply procedure outlined later in this text if positioning data is not readily available.**

**Accurate propeller balance indication and correction is dependent upon consistent projection of alignment and centralization established by the arbor shaft and attached propeller mount adapter to match like references of the propeller. Due to the projected distance from the shaft lower end to the propeller center of gravity, care must be taken to insure the contacting faces of both the mount adapter and propeller are free of foreign material and raised portion of nicks. Light flat stoning of nicks, careful surface cleaning and moderate but even torque of attachment points will control alignment error. Upon installation on the aircraft, a check of the engine flange for like conditions and their correction will further insure operational balance of the propeller.**

**Unbalance conditions are indicated by the Balance Indicator Arbor as a tilt of its outer shaft relative to the indicator collar attached to the central suspension rod. This tilt is observed visually at the top surface of the arbor shaft by noting the increased eccentric exposure of its black indicator disc insert as it moves radially outward from the edge of the indicator collar. The direction of this movement and resulting increased exposure is toward the heavy location in the part being balance checked. When installation for balance is made using correct Sensitivity Settings, Concentric exposure indicates the balance condition is well within limits established for the part and eccentric exposure to a tangent condition between**

**the collar and disc edges indicates balance is at established maximum tolerance limits.**

**Sensitivity, or the amount of indicator movement for a given unit of unbalance, can be adjusted to a desired value by raising or lowering the vertical position of the backbalance weight along the arbor shaft to shift the center of gravity position of the total suspended load. Within limits, raising the vertical position of the weight increases arbor sensitivity or indicator movement for a unit of unbalance and lowering will decrease. A condition of unstability will occur if the weight is located too high on the arbor. This unstability becomes evident and will cause the indicator to move to the outer limit of its travel in random directions making it impossible to achieve a centralized balance indication. Lower the backbalance weight to reestablish stability.**

**The following procedure will allow an existing sensitivity setting to be confirmed or establish a correct setting for a new or modified application,**

1. **Mount propeller and backbalance weight on arbor using proper adapters and procedure. Refer to instructions for the propeller model to be balanced.**
2. **Suspend the assembly, stabilize movements and observe the indicator for balance condition.**
3. **Place temporary balance weights on the part being checked to centralize the balance indicator. Check for possible unstability and correct by lowering the backbalance weight if found to exist.**
4. **Place a weight representing the desired balance tolerance on the part and observe balance indicator movement.**
5. **The correct position of the backbalance weight, or its Sensitivity Setting, for the desired balance tolerance will allow an unbalance of this amount to move the indicator from its initial central position to one with the edges of the black disc insert and indicator collar being tangent, without overlap. Movement less than tangent will require raising the weight vertically on the arbor to increase sensitivity. Movement exceeding tangent will require lowering the weight.**
6. **Following final backbalance weight positioning and indicator response check, observe the position of the top surface of the 2742 Anchor Ring supporting the weight relative to the etched scale on the arbor shaft and record for future use as the Sensitivity Setting.**

**Indicator movement of the 3015, 3037 Arbor is damped by dashpot action of the SAE 40 Engine Oil contained within the arbor between its shaft and central suspension rod. Screw sealed openings in the side of the shaft allow adding or removal of oil to obtain the desired indicator action which will respond readily to small unbalances but not allow continued oscillation movement.**

**Damping oil is retained within the arbor during shipment by two O Rings, one located between the indicator collar and indicator disc and one on the suspension rod immediately above the indicator collar. Prepare for use by removing both rings and reinstall the collar with approximately .006" clearance with the indictor disc. Reinstall both O Rings if the arbor is to be stored horizontally.**

**Long and accurate service life of the Balance Indicator Arbor can be insured by observing a few normal precautions and checks.**

1. **Inspect the balance indicator arbor and its propeller mount adapters for and remove foreign material and raised portions of nicks and corrosion.**
2. **Inspect the suspension cable for bends or other distortions and straighten or replace.**
3. **Check balance indicator operation for free movement over its full range of travel and reset for clearance if collar contracts indicator disc or shaft end. If a non-mechanical, gum type of adhesion is noted at the indicator travel limit, drain damping oil and flush with a mineral spirit type solvent. Refill to desired level with SAE 40 Viscosity Engine Oil.**
4. **Damage to the internal suspension rod can result from the arbor being dropped or its suspension rod extension being struck. Always install the protector on the arbor when installing or removing backbalance weights. Refer to propeller balance instructions.**
5. **When hoisting for balance indication, locate the hoist directly above the arbor to minimize side loading and avoid high shock forces possible when using powered hoist equipment.**

**An operational check of the 3015, 3037 Arbor can be made to verify balance indication accuracy using the following procedure after installation and other checks noted earlier have been observed. It is necessary that the propeller mount adapter attachment to the propeller not be loosened or rotated during this arbor check.**

1. **Prepare the propeller and suspend for balance indication. Moderately tighten set screw in side of mount adapter.**
2. **Locate temporary balance correction weights on the propeller or spinner bulkhead to centralize the balance indicator.**
3. **Place a reference mark on the backbalance weights at the arbor scale location. Loosen the set screw in the mount adapter and rotate the arbor, with weights, 180°. Check to insure the arbor to weight position has not changed. Moderately retighten the adapter set screw.**

**NOTE: Arbor rotation can be accomplished with the propeller suspended if rotation is restrained using the propeller hub or spinner bulkhead. Restraint by the blades can cause shift, voiding the accuracy of the check.**

**Lowering the propeller to a support for this rotation is acceptable if the support contacts the hub.**

4. **Recentralize the balance indicator, if necessary, using the equal weight corrections in units of two placed on the backbalance weight surface. Arbor error, if present, is represented by one weight of each of the added pairs. They may be retained in position as compensation during propeller balance correction after removal of all other weights including those originally placed temporarily on the propeller or spinner bulkhead.**
5. **Upon completed propeller balance correction using the error compensated arbor, 180° arbor rotations should indicate continuous balance within small limits if the reference position of the backbalance and remaining compensation weights is maintained at the arbor scale marking.**

**Balance indicator arbors found to consistently require correction by the described procedure should be returned to the manufacturer for inspection for possible damage and its correction.**